REMARKS

In view of the above amendments and following remarks, reconsideration and further examination are requested.

The specification and abstract have been reviewed and revised to make editorial changes thereto and generally improve the form thereof, and a substitute specification and abstract are provided. No new matter has been added by the substitute specification and abstract.

Claims 1-82 have been canceled and claims 83-105 have been added. New claims 83-105 have been drafted taking into account the 35 U.S.C. § 112, second paragraph, issues raised by the Examiner, are believed to be free of these issues, and are otherwise believed to be in compliance with 35 U.S.C. § 112, second paragraph.

The instant invention pertains to an electrolytic processing apparatus that includes a substrate holder for holding a substrate, a first electrode for being brought into contact with the substrate, a second electrode to be disposed facing the substrate, structure for introducing an electrolytic solution between the substrate and the second electrode, and a power source for applying a voltage between the first electrode and the second electrode. Such an apparatus is generally known in the art but suffers from drawbacks as expressed on pages 1-8 of the original specification.

Applicants have addressed and resolved these drawbacks by providing a unique electrolytic processing apparatus. Specifically, with reference to Figs. 3 and 11, for example, the inventive electrolytic processing apparatus comprises: a substrate holder 36 for holding a substrate W such that a surface, to be processed, of the substrate faces upwardly; a first electrode 88 for being brought into contact with the substrate so as to supply current to the surface of the substrate; a second electrode 98 disposed above the substrate holder such that when the substrate is held by the substrate holder the second electrode is substantially parallel to the surface of the substrate; a resistance structure 110 between the substrate holder and the second electrode such that when the substrate is held by the substrate holder the resistance structure is between the substrate and the second electrode; an electrolytic solution introducing portion 104 for

introducing an electrolytic solution, from laterally of the resistance structure, into a region across which the substrate and the resistance structure face each other when the substrate is held by the substrate holder; and a power source 114 for applying a voltage between the first electrode and the second electrode.

An important feature of the invention is that the substrate is to be held by the substrate holder with its surface, to be processed, facing upwardly, and the electrolytic solution is to be introduced into a region across which the substrate and the resistance structure face each other from laterally of the resistance structure so as to allow the electrolytic solution to flow along the surface of the substrate. Specifically, because the substrate is held with its surface facing upwardly and because the electrolytic solution is introduced from laterally of the resistance structure, air bubbles, which can adversely affect quality of plating, can be easily removed from the region between the substrate and the resistance structure by the flow of the electrolytic solution while preventing the electrolytic solution retained within the resistance structure from leaking from the resistance structure. Accordingly, the region between the substrate and the resistance structure is capable of being filled with fresh electrolytic solution whose composition has been adjusted, while air bubbles are prevented from remaining between the substrate and the resistance structure. Thus, Applicants' inventive electrolytic processing apparatus is suited for use in forming interconnects by embedding a metal (interconnect material) such as copper in fine interconnect recesses (interconnect pattern) that are formed in a surface of the substrate.

Each of independent claims 83 and 98 is believed to be representative of Applicants' inventive electrolytic processing apparatus.

Claims 16, 18, 20, 22, 24, 33, 35, 37 and 38 were rejected under 35 U.S.C. § 102(b) as being anticipated by WO '882 (Hosten et al); claims 1, 2, 4, 5, 9, 11, 13, 15, 16, 18, 20, 22, 24-26, 29, 31-33, 35, 37 and 38 were rejected under 35 U.S.C. § 102(b) as being anticipated by Reynolds; claims 1, 3-5, 12, 16 and 21 were rejected under 35 U.S.C. § 102(b) as being anticipated by Hanson et al; claims 19 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over WO '882; claims 10, 19, 30 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Reynolds; claims 10 and 19 were rejected under 35 U.S.C. § 103(a) as

being unpatentable over Hanson et al; claims 17 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over WO '882 in view of Dordi et al.; claims 8, 17, 28 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Reynolds in view of Dordi et al.; claims 8 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hanson et al. in view of Dordi et al.; claims 1, 3, 9-11, 13, 15, 25, 27 and 29-32 were rejected under 35 U.S.C. § 103(a) as being unpatentable over WO '882 in view of Kunisawa et al.; claims 8 and 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over WO '882 in view of Kunisawa et al. and further in view of Dordi et al.; claims 1, 2, 9-11, 13, 15, 25, 26 and 29-32 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Reynolds in view of Kunisawa et al.; claims 8 and 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Reynolds in view of Kunisawa et al. and further in view of Dordi et al.; claims 1, 2, 4-7, 9-11, 13, 15, 16, 18-20, 22, 24-26, 29-33 and 35-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kunisawa et al. in view of Reynolds.; and claims 8, 17, 28 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kunisawa et al. in view of Reynolds and further in view of Dordi et al. These rejections are respectfully traversed in part, and the relied-upon references are not applicable with regard to the newly added claims for the following reasons.

New independent claims 83 and 98 basically correspond to former claims 1 and 25, respectively, with amendments having been made thereto in order to more clearly bring out significant features of the invention. In this regard, each of claims 83 and 98 recite an electrolytic processing apparatus that includes

> a substrate holder for holding a substrate **such that a surface, to be processed, of the substrate *faces upwardly***...a first electrode... a second electrode...a resistance structure...an electrolytic solution introducing portion for introducing an electrolytic solution, from laterally of said resistance structure, into a region across which the substrate and said resistance structure face each other...**so as to allow the electrolytic solution to flow along the surface of the substrate**...and a power source.

Hosten et al. discloses an arrangement for enabling a liquid to flow evenly around a surface of a sample. In Hosten et al., a wafer 3 is arranged on an upper side of flow chamber 1,

and is rotatable about an axis perpendicular to its surface by a rotary drive 5. The Examiner has equated rotary drive 5 with the claimed substrate holder. However, because the wafer is arranged on the upper side of the flow chamber, the wafer 3 is held with its surface to be processed facing downwardly, and accordingly, rotary drive 5 of Hosten et al. is not a substrate holder for holding a substrate such that a surface to be processed ***faces upwardly*** as required by each of claims 83 and 98, whereby air bubbles are likely to remain on the surface of the substrate. Thus, neither claim 83 nor claim 98 is anticipated by Hosten et al.

Reynolds discloses a plating cell having a laminar flow sparger. In Reynolds, a substrate 18 is positioned by a rotary mount 22 such that the substrate is to be immersed in plating bath 12. The rotary mount 22 holds the substrate 18 such that a surface to be processed is directed in a downward direction, and accordingly, rotary mount 22 of Reynolds is not a substrate holder for holding a substrate such that a surface to be processed ***faces upwardly*** as required by each of claims 83 and 98, whereby air bubbles are likely to remain on the surface of the substrate. Thus, neither claim 83 nor claim 98 is anticipated by Reynolds.

Hanson et al. discloses an apparatus for electrochemically processing a microelectronic workpiece. In Hanson et al., head assembly 20 supports a workpiece 45 during processing, with a surface to be processed facing downwardly. Accordingly, head assembly 20 of Hanson et al. is not a substrate holder for holding a substrate such that a surface to be processed ***faces upwardly*** as required by each of claims 83 and 98, whereby air bubbles are likely to remain on the surface of the substrate. Thus, neither claim 83 nor claim 98 is anticipated by Hanson et al.

In supporting the rejection relying on Kunisawa et al. as a primary reference, the Examiner recognized that Kunisawa et al. does not include structure for introducing an electrolyte from laterally of the high resistance structure thereof, and thus, relied upon Reynolds to remedy this deficiency. However, it is respectfully submitted that one having ordinary skill in the art would not have found it obvious to modify Kunisawa et al. in view of the teachings of Reynolds. Specifically, in Kunisawa et al., the substrate to be plated is oriented horizontally with its surface to be plated facing upwardly, whereas in Reynolds the substrate to be plated is oriented "anywhere from vertical to about 45 degrees from vertical" (column 4, lines 6-8) with its

surface to be plated facing sideways or downwardly at an angle. Accordingly, because of the different orientations of the substrates to be processed in Kunisawa et al. and Reynolds, it is respectfully submitted that one having ordinary skill in the art would not have been motivated to combine the teachings of these references. In this regard, the laminar flow created by sparger 46 of Reynolds is to ensure a uniform distribution of liquid across a surface of a substrate oriented non-horizontally and not facing upwardly; however, there is no indication in Kunisawa et al. that the horizontally-arranged and upwardly-facing surface of the substrate thereof is subject to a non-uniform distribution of liquid thereacross. Indeed, as expressed in column 18, line 66 through column 19, line 21 of Kunisawa et al., plating liquid introduction pipe 104 is effective to "uniformly" supply plating liquid to the surface to be plated of the substrate. Thus, because the non-uniform distribution problem with which Reynolds is concerned is non-existent in Kunisawa et al., it is respectfully submitted that it is only through impermissible hindsight that the Examiner has concluded that it would have been obvious to modify Kunisawa et al. by introducing electrolytic solution from laterally of the substrate.

Additionally, according to the electroplating apparatus of Reynolds, a region between the substrate weir 20 cannot be filled with a fresh electrolytic solution whose composition has been adjusted.

Thus, neither of independent claims 83 and 98 is obvious from a combination of the teachings of Kunisawa et al. and Reynolds.

Dordi et al. does not resolve any of the above deficiencies of Hosten et al., Reynolds, Hanson et al. and Kunisawa et al., whereby claims 83 and 98 are allowable over the references relied upon by the Examiner either taken alone or in combination. Thus, claims 83-105 are allowable.

In view of the above amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and an early Notice of Allowance is earnestly solicited.

If after reviewing this Amendment, the Examiner believes that any issues remain which must be resolved before the application can be passed to issue, the Examiner is invited to contact the Applicants' undersigned representative by telephone to resolve such issues.

Respectfully submitted,

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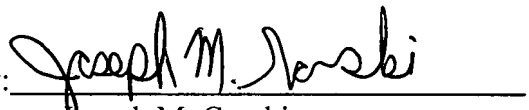
By: 

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